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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09 940,001	08 27 2001	Achim Gratz	PER-IN1022	3714

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EXAMINER

BOOTH, RICHARD A

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 01 27 2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/940,001

Applicant(s)

GRATZ, ACHIM

Examiner

Richard A. Booth

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) 14-17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 12.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-7, 9, and 11-13 are rejected under 35 U.S.C. 102(b) as being anticipated by Noble et al., U.S. Patent 5,973,356.

Noble et al. shows the invention as claimed including a vertical non-volatile semiconductor memory cell, comprising: a substrate having a surface, a drain region 505, a channel region and a source region 500; a trench 600 that is formed in said substrate from said source region to said drain region, said trench formed vertically, essentially perpendicular to said surface of said substrate, said trench having trench walls; a first dielectric layer 800 that is formed essentially on said trench walls; a charge storage layer 1000 for storing charges, said charge storage layer having a surface and essentially being formed on said first dielectric layer; a control layer trench 600 defined by walls; a second dielectric layer 340 that can comprise an oxynitride layer and is formed at least partially on said walls of said control layer trench; a control layer 335 that is formed essentially on said surface of said second dielectric layer 340 and that has a surface; a trench extension 1100 that is formed essentially underneath said trench, said trench extension having a surface; a third dielectric layer 705 located on said surface of said trench extension; and a filler material (1100 or the lower portion of

YG1) for at least partially filling said trench extension (see figs. 5-11 and col. 9-line 24 to col. 10-line 57). Note that the above structure can be applied to DRAM devices (see col. 14-lines 19-27). Furthermore, the division between the trench and the trench extension is arbitrary.

Regarding the method of formation of the control trench, process limitations are not given patentable weight in product claims.

Claims 1-7 and 11-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Bertin et al., U.S. Patent 5,468,663.

Bertin et al. shows the invention as claimed including a substrate having a surface, a drain region 42, a channel region, and a source region 45; a trench 30 that is formed in said substrate from said source region to said drain region, said trench formed vertically, essentially perpendicular to said surface of said substrate, said trench having side walls (see fig. 3); a first dielectric layer 54 that is formed essentially on said trench walls; a charge storage layer 59 for storing charges, said charge storage layer having a surface and essentially being formed on said first dielectric layer; a control layer trench defined by walls between, for example, the charge storage layers 59; a second dielectric layer 43 that is formed at least partially on said control layer trench; a control layer 65 that is formed essentially on said surface of the second dielectric layer and that has a surface; a trench extension that is formed essentially underneath said trench; a third dielectric layer surrounding the RG and located on said surface of said

trench extension; and a filler material (56 or 57) for at least partially filling said trench extension (see figs. 6, 10a, 12 and col. 7-line 18 to col. 14-line 35).

Regarding the method of formation of the control trench, process limitations are not given patentable weight in product claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Noble et al., U.S. Patent 5,973,356 or Bertin et al., U.S. Patent 5,468,663 in view of Hong et al., U.S. Patent 5,457,061.

Noble et al. and Bertin et al. are applied as above but lack anticipation of the second and third dielectrics being ONO layers. Hong et al. discloses an ONO dielectric 36 being used as a control gate insulator because of its high dielectric constant (see col. 3-lines 43-53). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the reference of Noble et al. or Bertin et al. so as to form the second dielectric of ONO because of its high dielectric constant. Regarding the third dielectric being ONO, the examiner takes official notice that commonly ONO dielectrics are used as trench masks to form trenches and later are left to form part of the final structure.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Noble et al., U.S. Patent 5,973,356 or Bertin et al., U.S. Patent 5,468,663 in view of Gregor et al., U.S. Patent 6,008,091.

Both Noble et al. and Bertin et al. are applied as above but lack anticipation of the second dielectric being a metal oxide. Gregor et al. discloses using a tantalum oxide layer between a control gate and a floating gate (see abstract). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Noble et al. and Bertin et al. so as to have a metal oxide as the second dielectric because the charge trap density is lower than in prior art dielectrics.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bertin et al., U.S. Patent 5,468,663 in view of Bergendahl et al., U.S. Patent 5,399,516.

Bertin et al., is applied as above but lacks anticipation of wherein the trench and the trench extension constitute a deep trench that is formed in a DRAM process. Bergendahl et al. discloses a trench extension that has a filler material 14 and is used for a deep trench in a DRAM device (see abstract). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the reference of Bertin et al. so as to include the deep trench in Bergendahl et al. because this will produce high density memory devices.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard A. Booth whose telephone number is 308-3446. The examiner can normally be reached on Monday-Thursday from 7:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 308-3325. The fax phone numbers for the organization where this application or proceeding is assigned are 308-7724 for regular communications and 308-7724 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-1782.



Richard A. Booth
Primary Examiner
Art Unit 2812